adjuncts. It is an excellent small book, suitably illustrated.

(3) This is described as an "attempt to provide an elementary book for those who are intending to enter the profession of electrical engineering." In a very entertaining and humorous preface the author at once enlists the sympathy of the ordinary reader in general, and of the reviewer in particular. After its perusal the latter feels prepared to find much that is novel in treatment and revolutionary in substance in the work itself, but he finds that his anticipations are only realised to a moderate degree. The so-called "Inductive Circuit" is easily recognised as an old friend under a new name. The equation of the condenser, usually written

Quantity = Capacity × Potential-Difference,

is given by the author in the form

Accumulation × Resistance = Electrical Pressure,

wherein he regards inductive resistance as bearing the same relation to capacity that electrical resistance does to electrical conductivity. The only advantage we can see in this notion is that it brings out clearly the fact that condenser capacities combine according to the same law as electrical conductivities. Again, the author imagines the "sapient critic" to laugh at his views of "loops" and "unlooping" in connection with the lines of force of a magnetic field, and puts a question to him which he evidently regards as a poser of the first water. He says: "Your teaching involves cutting here, there, and everywhere—first in this direction, then in that; but though you tell us what happens when you cut 'lines of force,' you say nothing of what happens when your conductor leaves those lines of force. You bring your conductor to be acted upon by lines of force, but although you also take your conductor from those lines of force, you recognise no reverse action. All your cry is 'Cut,' 'cut,' 'cut,' &c., &c."

This is of course veritable moonshine. Every electrician is aware that every line of force forms a closed loop, and that "cutting" necessarily involves looping or unlooping, as the case may be, and *vice versa*, whenever the conductor forms a closed circuit.

The first principles of the dynamo are clearly and accurately given, though a worse illustration than that of a gramme ring on p. 152 is not often to be seen. However, it is good to see a clear distinction between "energy" and the "rate of its production," all the more noticeable by reason of its rarity in recent electrical books.

Notwithstanding its eccentricity, the book will be useful to a certain class of student.

(4) Mr. Kilgour considers scientifically the design of systems of distribution which shall give maximum economy with satisfactory working results. This subject was initiated by the valuable papers of Lord Kelvin and of Profs. Ayrton and Perry. In 1881 the former considered the problem of finding the cross-sectional area of copper required for a conductor to transmit a given current in order that the total annual expenditure for the energy wasted in the conductor, and for interest, depreciation, and repairs on the conductor should be a minimum. This problem is now historical. It was on this occasion, the meeting of the British Association in the year mentioned, that Lord Kelvin first brought before engineers the fact that the relation between the size of the conductor and the current strength should be governed by economical considerations. As stated by Mr. Kilgour, six quantities are involved in an important manner, viz.:—V, the pressure in volts at end of feeder near to generators; v, the pressure in volts at end of feeder remote from generators; C, the current strength in ampères flowing through the feeder; P, the watts delivered to feeder; p, the watts delivered by feeder; and x, the cross-sectional area in square inches of the copper of feeder. These six quantities are obviously connected by three relations; we may further assume two other relations between them, and then a sixth relation deduced from economical considerations suffices to determine the whole of the six quantities. The two assumed relations may take the form of two of the quantities being given. This is what usually happens, and is always the case in the author's discussion. Of the fifteen possible cases Lord Kelvin investigated, that in which v and C are given; Prof. Ayrton, that in which V and C, and also that in which V and x are given; while Prof. Ayrton and Perry, in conjunction, before the Society of Telegraph Engineers and Electricians in 1886, considered V and p to be given quantities. The remaining eleven cases are completely examined by Mr. Kilgour, and in doing so, as well as by giving a clear exposition of the whole subject, he has rendered valuable service. To all those who are concerned with the design of systems of distribution, this part of the work will be found to be of high interest and usefulness. In Part ii. will be found a collection of descriptions of the systems which practical men have gradually evolved by knowledge and experience. The best mains and culverts, and also the means of maintaining them in a state of efficiency, in use in England and on the continent, are described in detail with a large number of excellent illustrations. The compilers have shown good judgment in the selections they have made from the many systems that have been adopted.

(5) This work is intended to afford to County Councillors and others similarly placed some information likely to be of use to them in dealing with questions of central station lighting. It is a small and unpretending work of some forty pages, and seems to have accomplished the object in view.

OUR BOOK SHELF.

The First Technical College. By A. Humboldt Sexton. Pp. 188. 1894. (London: Chapman and Hall.)

WHEN John Anderson became Professor of Natural Philosophy in the University of Glasgow, in 1786, he began to give instruction in science to persons engaged in industries. This was the beginning of technical education, and the future of the new line of study was to some extent provided for in Glasgow by its founder bequeathing the whole of his property "to the public for the good of mankind and the improvement of science in an institution to be denominated Anderson's University." The total value of the property, however, was only about £1000, and this, as Prof. Sexton remarks, was a small sum wherewith to start a new university which was to revolutionise the education of the country. But the gift formed a nucleus which attracted other benefactions,

©1894 Nature Publishing Group

and, after a short time, sufficient funds were raised to appoint a Professor of Natural Philosophy and Chemistry. Dr. Thomas Garnett was nominated for this post in May, 1796. Three years later Count Rumford founded the Royal Institution, and Garnett accepted the first professorship in it. He was succeeded at the Anderson's Institution by Dr. George Birkbeck, who afterwards assisted in founding the well-known Birkbeck Institution in London. Dr. Ure next occupied the chair, and when he retired it was decided to appoint two professors—one of Natural Philosophy and one of Chemistry. Among the men who occupied the former chair at different times were Dr. William Heron, Dr. John Taylor, Prof. Carey Foster, and Prof. A. S. Herschel. The chair of chemistry was successively filled by Thomas Graham, Dr. William Gregory, Dr. Penny, Dr. T. E. Thorpe, and Prof. Dittmar. About 1830 Graham established a public laboratory for experimental work in chemistry, the first of its kind in Great Britain, and among the students who worked in it were Dr. James Young, Lord Playfair, and Dr. Walter Crum. Into the various changes which the institution has undergone we do not propose to enter. Suffice it to say that Anderson's College, the Mechanics' Institute, and the Allan Glen's School were united in 1882 to form the Glasgow and West of Scotland Technical College. The Mechanics' Institution, or College of Science and Arts, mentioned in this connection, was founded in 1823 as the result of the secession of some members of the Anderson's Institution. Lord Kelvin and his brother, the late Prof. James Thomson, studied for some time at the former institution.

The present Technical College, and the institutions from which it was formed, has had many distinguished men among its teachers and students. Prof. Sexton's history of the whole organisation is not merely of local interest, but appeals to all interested in the growth of technical education. The illustrations in his book are numerous, but mostly very bad, and the descriptive text might have been far more brightly written.

Practical Work in General Physics. By W. G. Woollcombe, M.A., B.Sc. Pp. 83. (Oxford: Clarendon Press, 1894.)

INSTRUCTION in practical physics is steadily, though very slowly, gaining ground in our schools and colleges. The tardy recognition of the great importance of this kind of work is doubtless due to the fact that practical physics does not bear directly on industrial and commercial pursuits. But, for training the mind, there is no better means than a course of physical laboratory practice. The hand is exercised in delicacy of manipulation; the eye is led to perceive instead of seeing things vacantly; and the mind is trained to make scientific deductions from observed facts. Whether a boy is designed to be a politician or a preacher, whether it is intended that he should follow the law or be sacrificed to science, in fact, no matter what the calling or profession in which he has to work his way through life, by far the best mode of obtaining the accuracy of observation and deduction desirable in everyone, is through instruction in practical physics. It is because we believe this, that we welcome any indication of the extension of such knowledge. Mr. Woollcombe is the author of a little book on practical work in heat, which we were able to commend when it appeared. The present volume deserves the same praise that we gave the previous one. It begins with descriptions of such instruments as the linear vernier, sliding callipers, micrometer screw gauge, and balance, and passes on to the measurement of length, area, and volume. The experiments performed under these heads lead naturally to the determination of the densities of solids, liquids, and gases, and then to Boyle's Law, the barometer, and capillarity. This order is practically the same as that followed in "A First Course of Physical Laboratory Practice," by Prof. A. M. Worthington, F.R.S., published eight years ago. Indeed, Mr. Woollcombe's book reminds us of Prof. Worthington's in more than one respect; but a similarity of gradation and general treatment almost inevitably exists between books covering the same ground.

The author is among those who take every opportunity of correcting the sense in which the word *weight* is generally understood. An aphorism of his worth quoting is: "We can no more lock up forces in a box than Pandora could imprison Hope in a casket, so that it is incorrect to talk of a *box of weights*—the correct term being a *box of masses*." We hope that a time will come when books similar to the one under notice will be required in all our public schools and colleges.

Manual of Practical Logarithms. By W. N. Wilson, M.A. (London: Rivington, Percival, and Co., 1894.)

THE great importance of a sound knowledge of the use of logarithms, and the frequency of their application in the majority of sciences, is sufficient to account for the appearance of such books as that under review, entirely devoted to their exposition. The subject is treated to a small extent in many of the larger text-books on algebra and trigonometry, but their insertion there is more to acquaint the student with the principles than to give him a good working knowledge, which can only be obtained by constant solving of problems.

In the book which we have under notice, the author assumes that the reader has had such a smattering of the subject as above suggested, since he purposely omits the propositions and formulæ found in most of the text-books, and devotes his whole attention to the treatment of various methods of solving problems with their aid. The examples dealt with, illustrate those branches of arithmetic, algebra, plane trigonometry, and mensuration, and those that are worked out are given in the forms that the student himself is advised to adopt.

The author deviates here from the usual method of writing the characteristic before the mantissa, by placing it afterwards. His reason for doing so is that he thus avoids the necessity of using the old and clumsy notation, as he calls it, for denoting the combination of a negative characteristic with a positive mantissa. The method here adopted has, no doubt, its advantages, and might facilitate matters for beginners, who nearly always find this a difficult point to surmount.

The reader is supplied with plenty of examples to practise his ingenuity upon, many of them being selected from various examination papers for the Army, Navy Oxford, and Cambridge, &c.

In the absence of any external assistance, close attention to the methods of solution employed in the book should give the reader a good insight not only in the right way of handling and becoming familiar with tables, but in the art of successfully attacking problems by their aid.

W. J. L.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

Towards the Efficiency of Sails, Windmills, Screw-Propellers, in Water and Air, and Aeroplanes.

THE discussion of this day week, on flying machines, in the British Association was not, for want of time, carried so far as to prove from the numerical results of observation put before the meeting by Mr. Maxim, that the resistance of the air against

©1894 Nature Publishing Group